APPENDIX A. CLASSIFICATION-SPECIFIC QUALIFICATION PROGRAM

This appendix contains content suggestions that can serve as a starting point for the analysis of the job, its tasks, and a classification-specific qualification program. The list of tasks should be surveyed for those that are and are not appropriate, and then tasks should be identified that are missing. This approach is a simplified version of the process required by DOE Order 5480.18B, "Nuclear Facility Accreditation Training Program" (8-31-94).

Classification-specific content is suggested for each level with completion leading to designation of qualification at the beginning of the next level. Much of the subject matter will remain the same through each level with the differences being in terms of the degree of mastery required. For example, application of ANSI/ANS-8 standards (or other key documents and procedures) during qualification while at the following level may involve

- Entry-Level -- familiarity with content and application, e.g., from reading and making lists of the major requirements and recommendations;

- Apprentice -- ability to use applicable standards, seeking interpretation where necessary; and

- Specialist -- ability to interpret applicable standards for facility use and compliance.

The extent of requirements also should be established, e.g., length of in-facility assignments and number of evolutions such as computer-code evaluations for subcriticality.

A.1 Entry-Level to Apprentice qualification. Qualification of personnel at the Entry-Level is comprehensive because upon completion the designation as Apprentice implies that the candidate is deemed capable to perform each of the major tasks under the close supervision of a Senior Specialist. Where functional specialties are designated, further qualification is not required on specific tasks in the interface areas (e.g., implementation and confirmation for those who perform analysis and evaluation tasks) after conclusion of the Entry-Level activities.

This portion of the qualification should be evaluated with a combination of written examinations, oral boards (if appropriate), and practical exercises (e.g., actual or simulated work-product).

The actual content of the Entry-Level qualification program will be derived from the analysis of the job and its tasks. General areas and issues to be addressed include

- facility familiarization --

    - standard courses (e.g., radiation safety, industrial and other safety, and security),
    - facility tours,
    - routine inspection and surveillance activities,
    - physical-area and functional audits,
    - in-facility, on-shift assignments, and
    - process fundamentals;

- organization familiarization --

- job responsibilities and authorities,
- overview of entire NCSS task lists (with functional specialization if implemented) including why and how each task is performed, and
- organizational and interface responsibilities;

• administrative practices --

- NCS procedures and practices,
- other procedures and policies,
- safe operating conditions, limits, and postings,
- emergency planning,
- incident reporting,
- standards and guides,
- DOE Orders, contractual commitments, and
- interfaces with analysis and evaluation processes;

• reference materials --

- ANSI/ANS-8 Standards,
- TID-7016,
- LA-10860-MS,
- LA-3366,
- ARH-600, and
- Nuclear Criticality Safety - Theory and Practice book;

• working contacts --

- line managers and selected staff,
- safety manager(s) and other personnel,
- corporate NCS personnel,
- shift managers, and
- operations support managers;

• theory --

- nuclear physics, and
- neutron chain-reaction physics;

• nuclear criticality safety --

- methods of criticality safety control (by material/facility type),
- criticality accident history, and
- criticality detection and emergency procedures;

• safety analysis requirements and methods --

- process analysis,
- risk assessment, and
- interfaces with other disciplines;

- *evaluation for subcriticality --*
  - hand calculations,
  - computer-code use and interpretation,
  - critical experiments and methods validation, and
  - computer resources; and
- attendance at short courses, where examples have been --
  - University of New Mexico's Nuclear Criticality Safety Short Course,
  - University of New Mexico's Nuclear Criticality Safety Workshop, and
  - Los Alamos National Laboratory's Criticality Safety Courses.

Examples of work products applicable to each NCSS candidate include

- analysis -- perform or review part or all of an analysis (e.g., "double- contingency"),
- evaluation -- run computer code calculations for subcriticality with at least standard problems and one code package typical of those used at the facility,
- implementation -- write and check out a portion or all of a procedure, and
- confirmation -- accompany one or more teams performing regularly scheduled facility or functional audits.

A.2 Apprentice to Specialist qualification. At the Apprentice level, qualification becomes individualized using structured OJT under the guidance of a Senior Specialist mentor. Subject matter is similar to that at the entry level but with emphasis shifted to application of knowledge and, if specialization is implemented, from general to specifics of the specialty and related fields.

Learning objectives include

- distinguishing among the diffusion theory, discrete ordinates, and Monte Carlo calculational methods in terms of --
  - general methodology,
  - applicability,
  - advantages and limitations, and
  - "good answers" / convergence approaches and criteria / uncertainty and bias;
- considering reaction cross sections, explaining application of --
  - continuous versus multi-group, advantages and disadvantages,
  - Hansen-Roach 16-group versus ">16-group" sets,
  - resonance treatment (resolved and unresolved),
  - multi-group flux weighting collapsing, and
  - pitfalls;
- describing and participating in benchmarking relative to installation problems;

- evaluating code output (if never seen before, with minimum instruction) --

  - reconstruction of geometry arrangement and material,
  - k-value and uncertainty, as applicable,
  - convergence,
  - comparison to physical system modeled -- define limiting conditions (e.g., within scope of calculations; beyond which need new calculations), and
  - parametric studies;

- providing a description of a facility/process/component (preferably, from "walk-around") and developing --

  - conservative geometry and material specifications,
  - normal conditions,
  - accident conditions, and
  - parametric studies; and

- intermediate level process description.

Examples of applicable work products (in the designated specialty and related functions) include

- analysis -- performing the criticality safety portion of an analysis (including double-contingency analysis),

- evaluation -- running computer code calculations for subcriticality on new, actual problems using each of the code packages employed at the facility,

- implementation -- writing and checking out procedures,

- confirmation -- participating in audits as a team member, and

- oral board -- participating.

A.3 Specialist to Senior Specialist qualification. At the Specialist level qualification continues using structured OJT under the guidance of a Senior Specialist mentor. Subject matter focus shifts from use or participation to leadership and initiative. The candidate begins to provide peer review and task quality assurance checks on the work of others (which, in turn, is subject to review by the Senior Specialist to an extent that decreases with the candidate's experience). Increased emphasis also is placed on professional development activities, e.g., active participation in courses, seminars, and workshops to gain subject matter expertise, and in professional organizations and committees to interact with peers in other organizations and at other facilities.

Examples of applicable work products (in the specialty) include

- analysis -- performing nuclear criticality safety analyses (including "double contingency"), and interfacing the results with those from other safety disciplines and management directives,

- *evaluation -- running computer code calculations for subcriticality and providing task* quality assurance reviews of calculations performed by others on new, actual problems using each of the code packages employed at the facility,

- implementation -- establishing the need for, writing, and verifying the accuracy and workability of procedures, and

- confirmation -- organizing and serving as team leader for each type of confirmation activity.

A.4 Senior Specialist qualification. Once the NCSS candidate qualifies as a Senior Specialist, the anticipated mode-of-progression culminates. Work products will be generated during the normal course of work. If functional specialties are designated, the work products should be consistent with, or better than, the function-classification table (i.e., Senior Specialist level in the specialty, Specialist level in the related area, and Apprentice level in the interface area). Periodic assessment of primary tasks should occur to ensure that qualification levels and specialization are consistent. If a change has occurred (e.g., a shift from performing analysis and evaluation to implementation and/or confirmation tasks), reentry to the qualification process may be required.

The Senior Specialist is required to maintain continuing competence, as described at the end of the next section, on functional specialization. Additional specialization (e.g., risk assessment, new computer code packages, human factors engineering, or root-cause analysis) also may be appropriate, consistent with the collective capability of the organization.

Professional development activities should be increasingly leadership-oriented (e.g., chair of a committee, paper session organizer and speaker, or instructor at a seminar or short course). Training and education on selected management skills is appropriate to all Senior Specialists as related to expected leadership and initiative in seeking out and resolving criticality safety concerns.

The individual who shows particular interest in, and promise for, an eventual supervisory or management position should be provided opportunities for appropriate formal training and education. A qualification program should have increasing emphasis on Lead Specialist assignments. (Note again that Senior Specialist is the highest level in the anticipated mode-of-progression. Lead Specialist positions are likely to be available only on a case-by-case basis.)

A.5 Lead Specialist qualification. The Lead Specialist whose major discipline is nuclear criticality safety is required to maintain continuing competence as a Senior Specialist. It may be appropriate to recognize that the supervisory or management responsibilities are often consistent with the leadership requirements. Additional training and education on technical management skills should be required.

Supervisors or managers with the direct responsibility for nuclear criticality safety may be qualified primarily in another safety discipline, especially in multi-discipline safety organizations. Where it is appropriate to designate a Senior Specialist as having lead responsibility, the supervisor/manager should, at a minimum, be qualified as Apprentice and meet each of the continuing competence requirements with work products performed at that level. When supervisors/managers do not have an experienced Senior Specialist available to assign Lead Specialist responsibility, their own or a subordinate's qualifications should be upgraded on an established schedule that is predicated upon a job task and needs analysis.